



Interdisciplinary Journal
of Information, Knowledge,
and Management

An Official Publication
of the Informing Science Institute
InformingScience.org

IJKM.org

Volume 19, 2024

**STUDENT ACCEPTANCE OF LMS IN INDONESIAN HIGH
SCHOOLS: THE SOR AND EXTENDED GETAMEL
FRAMEWORKS**

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ABSTRACT

Aim/Purpose	This study aims to develop a theoretical model based on the Stimulus-Organism-Response (SOR) framework and the General Extended Technology Acceptance Models for E-learning (GETAMEL) framework, which cover environmental, personal, and learning quality aspects to identify factors influencing students' acceptance of the use of Learning Management Systems (LMS) in high schools, especially after the COVID-19 pandemic.
Background	After the COVID-19 pandemic, many high schools reopened for in-person classes, which led to a decreased reliance on e-learning. The shift from online to traditional face-to-face learning has influenced students' perceptions of the importance of e-learning in their academic activities. Consequently, high schools are facing the challenge of ensuring that LMS can still be integrated into the teaching-learning process even after the pandemic ends. Therefore, this study proposes a model to investigate the factors that affect students' actual use of LMS in the high school environment.

Accepting Editor Geoffrey Z. Liu | Received: May 10, 2024 | Revised: August 17, August 18, 2024 |
Accepted: August 19, 2024.

Cite as: Nofita, M., Handarkho, Y. D., & Mudjihartono, P. (2024). Student acceptance of LMS in Indonesian high schools: The SOR and extended GETAMEL frameworks. *Interdisciplinary Journal of Information, Knowledge, and Management*, 19, Article 25. <https://doi.org/10.28945/5367>

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Methodology	This study used 890 high school students to validate the theoretical model using Structural Equation Modeling (SEM) analysis to deliver direct, indirect, and moderating effect analysis.
Contribution	This study combines SOR and acceptance theory to provide a model to explain high school students' intention to use technology. The involvement of direct, indirect, and moderating effects analysis offers an alternative result and discussion and is considered another contribution of this study from a technical perspective.
Findings	The findings show that perceived satisfaction is the most influential factor affecting the use of LMS, followed by perceived usefulness. Meanwhile, from indirect effect analysis, subjective norms and computer self-efficacy were found to indirectly affect actual use through perceived usefulness as a mediator. Content quality was also an indirect predictor of the actual use of LMS through perceived satisfaction. Further, the moderating effect of age influenced perceived satisfaction's direct effect on actual use.
Recommendations for Practitioners	This study provides practical recommendations that can be useful to high schools and other stakeholders in improving the use of LMS in educational environments. Specifically, exploring the implementation of LMS in high schools prior to and following the COVID-19 outbreak can offer valuable insights into the changing educational environment.
Recommendations for Researchers	The results of this study present a significant theoretical contribution by employing a comprehensive approach to explain the adoption of LMS among high school students after the COVID-19 pandemic. This contribution extends the GETAMEL framework by incorporating environmental, personal, and learning quality aspects while also analyzing both direct and indirect effects, which have not been previously explored in this context.
Impact on Society	This study provides knowledge to high schools for improving the use of LMS in educational environments post-COVID-19, leading to an enhanced teaching-learning process.
Future Research	This study, however, is limited to collecting responses exclusively from Indonesian respondents. Therefore, the replication of the finding needs to consider the characteristics and culture similar to Indonesian students, which is regarded as the limitation of this study.
Keywords	SEM, Learning Management System (LMS), high school, GETAMEL, SOR

INTRODUCTION

The pandemic spread throughout the world and impacted educational institutions, making teaching and learning processes unable to be conducted in offline classes. Distance learning is proposed to facilitate the continuation of education through digital technology (Dhawan, 2020). Consequently, transitioning from traditional face-to-face to online learning creates a new experience for students and educators. They should adapt to the new conditions for the sake of "Education in Emergency" (Pokhrel & Chhetri, 2021), and one of the platforms that can be used is the Learning Management System (LMS). This platform offers an opportunity for the education world to maintain the learning and teaching process, especially for teachers responsible for providing quality learning. LMS integrated several media in one platform to facilitate communication and collaboration with every entity involved while conducting a teaching-learning process through information technology (Al-Maatouk et al., 2020; Al-Rahmi et al., 2019).

However, after the COVID-19 pandemic, many high schools have resumed their regular routines by conducting in-person classes, which has decreased their dependence on e-learning. This transition from online to traditional face-to-face learning after the COVID-19 pandemic significantly impacted both educators and students in conducting learning activities (Marandu et al., 2023). Specific to students, this shift has affected their perceptions of the importance of e-learning in their academic activities. As a result, high schools face the challenge of ensuring that LMS can still be integrated into the teaching-learning process even after the pandemic ends. Furthermore, several technical requirements are still needed to make LMS an effective solution in schools, including skill in using technology, support hardware, and even reliable internet connection, affecting the intention to engage with the platform (Alshehri et al., 2019). The success factor of utilizing LMS at the high school level should also be investigated from the student's perspective. This is because not all students fully benefit from utilizing this platform during the learning process, causing LMS to remain underutilized. The attitude toward this method also determines the successful use of the platform, especially in creating an engaging environment for both students and teachers supporting the online teaching-learning process. Therefore, this study proposes a model to investigate factors that affect students' actual use of LMS in the high school environment. According to Alturki and Aldraiweesh (2021), the topic has yet to be extensively explored, including in developed countries. Therefore, it can bring alternative contributions toward using LMS in the high school context.

Several prior studies use acceptance theory, such as the Theory Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT), as a basis to propose a model to understand the use of LMS (Alturki & Aldraiweesh, 2021; Hamid et al., 2020; Raza et al., 2021; Stockless, 2018; Zwain, 2019). For the e-learning context, prior studies developed a model by extending TAM into General Extended Technology Acceptance Models for E-learning (GETAMEL) (Cheng & Yuen, 2022; Kimathi & Zhang, 2019; Matarirano et al., 2021). Although TAM and UTAUT have been widely used, they may not be fully applicable in the context of e-learning environments in Indonesia. Moreover, previous studies that employed TAM and UTAUT have highlighted their limitations, which has led to the exploration of alternative frameworks like GETAMEL. This model uses usefulness and ease of use, which are internal constructions from TAM, followed by adding five external factors: computer anxiety, enjoyment, experience, self-efficacy, and subjective norm in accepting e-learning (Abdullah & Ward, 2016). These external factors involve social and environmental factors and students' traits and experiences with the system, which were found to affect user perception of the usefulness of e-learning (C.-T. Chang et al., 2017; Rizun & Strzelecki, 2020). Additionally, contextualizing GETAMEL within Indonesia's educational context is crucial, as emphasized by studies by Handarkho (2022) and Anindito and Handarkho (2022), which underscore the impact of individual traits and environmental factors influenced by Indonesia's socio-cultural nuances. Integrating the Indonesian context grounds the framework within the specific cultural and educational context, ensuring its relevance to the study population.

Therefore, this study proposes a model to explain the acceptance of LMS in high schools by involving the learning process, environmental aspects, and student personal traits to offer a comprehensive understanding. From an environmental aspect, this study uses factors derived from the educational environment. This is because student LMS adoption is also affected by opinions from others considered essential to students, such as teachers and the school, through the declared policy (Bao, 2020; Binyamin et al., 2018). From the learning process aspect, this study proposes that teaching-learning quality is essential to students' adoption. In the context of LMS, the learning process can be measured through the quality of communication and interaction between teachers and students on the platform. This encourages the students to explore the subject through the material and content provided (Baber, 2021; Cigdem & Ozturk, 2016; Liaw, 2008). Meanwhile, a personal trait is also considered a substantial construct that needs to be involved due to the implication of individual intention and motivation to conduct specific behavior (Handarkho, 2022). Anindito and Handarkho (2022) also put personal traits as a construct that needs to be considered in constructing user behavior. This approach is suitable for the Indonesian population. According to the Culture Factor Group (2024),

individuals in Indonesia typically adhere to societal norms, avoid conflict, and expect clear instructions. Therefore, by focusing on social aspects and promoting communication and interaction between teachers and students on the platform, a deeper understanding of students' intention to use the LMS in their learning activities can be discussed comprehensively.

Overall, the use of environmental, personal, and learning quality involvement offers a comprehensive approach that enriches understanding of students' LMS acceptance in high school. To underline the three aspects, this study employs the Stimulus-Organism-Response (SOR) framework from Mehrabian and Russell (1974) as a foundation theory to explain students' adoption. This SOR framework is a suitable theoretical model for explaining e-learning adoption due to its comprehensive coverage of the factors that affect students' acceptance of LMS. In detail, the SOR theory describes how an individual's behavior is affected by various factors (Zhai et al., 2020), including the interplay between the environment and individual traits, which leads to the user's organism and establishes their actual use of LMS.

Profoundly, the involvement of the three aspects mentioned above requires a framework that can explain how these factors trigger student adoption of LMS, especially in relation to the GETAMEL framework, which is believed to influence students' behavior in LMS adoption. In this research, the adoption of SOR modeling involves a **Stimulus** representing an independent variable. This variable consists of environmental, personal, and learning quality aspects that affect an **Organism** construct as a mediator variable. The **Organism** construct includes factors from GETAMEL. **Response** serves as the dependent variable, which refers to the actual use of LMS. Several prior research also already utilized the SOR framework to explain students' behavior related to online learning, making this framework reliable to use in this context (Majeed et al., 2022; Pandita et al., 2021; Thi et al., 2023; Zhai et al., 2020; Zhou et al., 2022).

Finally, this study aims to develop a theoretical model based on the SOR and GETAMEL framework, which covers environmental, personal, and learning quality aspects to identify factors influencing students' acceptance of the use of LMS in high schools, especially after the COVID-19 pandemic. It offers a comprehensive analysis by examining direct and indirect effects using SEM analysis. The result provides both theoretical and practical contributions that can be useful to high schools and other stakeholders in improving the use of LMS in educational environments. Specifically, exploring the implementation of LMS in high schools prior to and following the COVID-19 outbreak can offer valuable insights into the changing educational environment. Understanding the patterns of LMS adoption after the pandemic can provide a detailed perspective on the difficulties and possibilities of integrating LMS into traditional classroom settings.

This paper is organized as follows. The next section is a review of relevant studies and the development of hypotheses based on the theoretical framework. This is followed by an outline of the research design and methodology used for data preparation and analysis. The subsequent section provides details about the theoretical model and measurement used in this study. The next section presents the data preparation and descriptive analysis, followed by the analysis of direct and indirect effects. Findings, practical and theoretical contributions, as well as limitations and conclusions, are presented in the final sections.

LITERATURE REVIEW

Several prior studies used a general acceptance model, such as TAM and UTAUT, to develop the theoretical model for understanding LMS acceptance by students (Al-Mamary et al., 2023; Alturki & Aldraiweesh, 2021; Attuquayefio, 2023; Hamid et al., 2020; Quiban, 2024; Rani et al., 2023; Raza et al., 2021; Songkram et al., 2023; Stockless, 2018; Zwain, 2019). Some studies used GETAMEL, the modification of the TAM model to make it suitable for the e-learning usage context (Cheng & Yuen, 2022; Kimathi & Zhang, 2019; Matarirano et al., 2021). Specifically, it involves intervening in envi-

ronmental factors and individual personality characteristics as a basis for developing a model to understand students' LMS acceptance. However, in the context of the pandemic, the investigation of LMS usage from environmental and personal trait factors has not been discussed extensively. The use of quality learning processes in an LMS environment can also be considered an addition that can enrich the findings (Baber, 2021). Therefore, the involvement of the environment, students' personal traits, and aspects of the learning process, wrapped by SOR theory, make this study offer a total contribution toward understanding LMS acceptance. The summary of prior related studies mentioned above is presented in Table 1, based on the order of time.

Table 1. Overview of previous studies

Research focus	Basic theory	Variables used	Source
Exploring the various factors that have affected the acceptance and adoption of LMS.	Extended Theory Acceptance Model (Extended TAM)	Attitude, acceptance of the use of LMS, usefulness, ease of use, technological skills, access to technology, and computer self-efficacy	(Quiban, 2024)
Explore students' intentions and behaviors in relation to a digital learning platform.	Extended TAM)	Usefulness, ease of use, technology self-efficacy, subjective norms, facilitating condition	(Songkram et al., 2023)
Identify the factors that drive students' behavioral intentions (BIs) and their actual usage of LMSs	TAM3	Job relevance, output quality, enjoyment, subjective norms, usefulness, ease of use, behavioral intention, and use behavior.	(Attuquayefio, 2023)
Discover the key factors that determine students' motivation to utilize LMS.	TAM; Expectation Confirmation Model (ECM)	Confirmation, usefulness, ease of use, satisfaction, behavioral intention, actual usage	(Al-Mamary et al., 2023)
Investigate the factors influencing students' use of LMS to improve pedagogy efficiency.	TAM	Student education, self-efficacy, quality of system, ease of use, usefulness, behavior intention, actual usage of LMS	(Rani et al., 2023)
Investigate the factors of acceptance and continued use of LMS	General Extended Technology Acceptance Models for E-learning (GETAMEL)	Cognitive, emotional, and behavioral	(Cheng & Yuen, 2022)
The Effect of Social Isolation and the Moderating Role of Corona Fear on Behavioral Intentions to Use LMS Among Students.	Unified Theory of Acceptance and Use of Technology (UTAUT)	Performance Expectations (PE), Effort Expectations (EE), Social Influence (SI), and Social Isolation	(Raza et al., 2021)
Knowing the factors of student acceptance in using the LMS	GETAMEL	Subjective norm, computer enjoyment, computer experience, computer self-efficacy, perceived usefulness, perceived ease of use	(Matarirano et al., 2021)
Investigate the factors influencing students' intention to utilize LMS during the COVID-19 online pandemic	Extended TAM	Student-perceived closeness, peer references, subjective well-being, perceived ease of use, and perceived usefulness	(Alturki & Aldraiweesh, 2021)

Research focus	Basic theory	Variables used	Source
Investigate the factors influencing the adoption of LMS use by teachers in university	Extended TAM	System quality, perceived self-efficacy, and facilitating conditions.	(Fearnley & Amora, 2020)
Investigate whether privacy factors can develop perceptions of knowledge-hiding in online learning	Stimulus-Organism-Response paradigm (SOR)	Privacy concern and knowledge hiding perceptions	(Zhai et al., 2020)
Exploring the factors that influence students' intentions to use the LMS and explain the effectiveness of its use	Technology Acceptance Model (TAM)	Perceived ease of use and perceived usefulness, System Design, System Accessibility, Technical Support, and Subjective Norms	(Hamid et al., 2020)
Describes the effects of technological innovation and information quality, learning value, and other determinants that influence faculty and student acceptance of the Moodle Learning Management System	Expansion of the UTAUT2 model	Performance expectancy, effort expectancy, social influence, facilitating conditions, learning value, hedonic motivation, habit, technological innovativeness, and information quality	(Zwain, 2019)
Determine the factors that influence the intention to use the e-learning system by students	GETAMEL	Perceived usefulness, perceived ease of use, subjective norm, perceived enjoyment, experience	(Kimathi & Zhang, 2019)
Identify the factors that influence teacher acceptance of the LMS	TAM	Perceived usefulness, ICT use, and the affordances of LMS educational features	(Stockless, 2018)

LMS ADOPTION IN INDONESIA

LMS is a web-based learning platform that facilitates online activities, enables collaboration and interaction, and provides content that students and teachers can access (Mohd Kasim & Khalid, 2016; Nasser et al., 2011; Srichanyachon, 2014). This platform can integrate various pedagogical approaches, supported by course administration tools that support online learning (Coates et al., 2005). During the COVID-19 pandemic, the government closed many physical places to minimize the spread, including schools, universities, and many educational institutions that switched traditional teaching and learning activities to online (Bao, 2020; Weerathunga et al., 2021). This migration process faced many challenges, including teachers' and students' adjustment toward LMS usage. Therefore, investigating students' acceptance of LMS usage becomes a study that can minimize its use in the current pandemic.

According to the Culture Factor Group (2024), individuals in Indonesia typically adhere to societal norms, avoid conflict, and expect clear instructions, which are also reflected in the educational context. Specifically, students in Indonesia still need assistance from teachers for their learning activities (Rifa'i, 2023). This indicates that high school students in Indonesia often look to their teachers for clear direction and support, including when using online learning. Lim et al. (2023) state that engagement with teachers significantly impacts the online learning process. This demonstrates that the power distance ingrained in Indonesian society (Culture Factor Group, 2024) is also evident in student behavior. Students perceive teachers as the main sources of knowledge, including in the adoption of LMS. Consequently, students might be reluctant to use LMS on their own unless their teachers explicitly encourage and incorporate it into their learning (Ermilinda et al., 2024).

SOR AND GETAMEL FRAMEWORK

A model was proposed using the SOR framework and GETAMEL as a grounded theory to offer a model involving environmental, personal, and learning quality aspects in identifying predictors of students' acceptance of LMS usage. The SOR theory, introduced by Mehrabian and Russell (1974), explained that the process of individual attitude begins from a stimulus (S), which consists of a set of signs or triggers causing an internal evaluation (O) to produce a response (R) (Zhai et al., 2020). The process stages are translated into a model of stimulus as an independent, an organism as a mediator, and a response serving as the dependent variable. Meanwhile, GETAMEL modifies the TAM model to make it suitable for the e-learning context (Cheng & Yuen, 2022). It tries to explain usage intention using usefulness and ease of use as mediator constructs, followed by external predictors of social, environmental, student traits, and experience factors (Abdullah & Ward, 2016; Rizun & Strzelecki, 2020). External factors include computer anxiety, enjoyment, experience, self-efficacy, and subjective norms. Comprehensively, GETAMEL explains that usage intention is derived from the interplay of environmental factors and individual personality traits, which affect their perception of the system. However, this study proposed satisfaction as a factor that needs more exploration than ease of use. This is because recent LMS, such as Moodle, already provide a function and features that are easy to use and access and accommodate teacher and user needs to support the online learning process (Quansah & Essiam, 2021). Further, satisfaction is also suitable for capturing and explaining individual expectations toward the use of the system, which leads to user actual use (Handarkho et al., 2021), making this study propose the construct to replace the ease of use.

HYPOTHESES AND THEORETICAL MODEL

SOR theory describes how an individual's behavior is affected by a stimulus derived from various factors, including the interplay between environment and individual traits (Zhai et al., 2020). In this context, stimulus reflects the factors affecting students adopting LMS. Furthermore, organism refers to internal emotions and psychological processes that mediate between stimulus and response (Zhai et al., 2020). It relates to students' perception of the usefulness and satisfaction of LMS usage, which is affected by factors from the stimulus. The response explains the individual behavior outcomes as a consequence of using LMS (Pandita et al., 2021). The three stimuli, Organism, and Response from SOR, can be used to propose a model based on the GETAMEL framework to investigate factors affecting students' acceptance of LMS usage.

For stimulus, this study proposed four independent variables involving environmental, personal traits, and learning aspects as predictors that affect students' perception. First, this study believes that user acceptance of particular systems is affected by others' behavior. Therefore, this study proposes a subjective norm as a construct that represents this aspect. Subjective norm refers to the social pressure derived from other opinions and views and has been found to have a significant impact on technology adoption and usage (Abdullah & Ward, 2016; Bao, 2020; Lisana & Handarkho, 2022; Plaza-Lora & Villarejo-Ramos, 2017; Ramirez-Anormaliza et al., 2016). This construct can influence students' decisions to adopt an e-learning system in the educational environment through the attitudes of other close friends, teachers, and schools (Binyamin et al., 2018). However, this study projects subjective norms as a social pressure derived from the teachers' and schools' opinions about the importance of LMS in supporting the learning process. These primarily implemented influences will lead to students' perception of the platform's usefulness in supporting the learning process. Several prior studies also confirm the effect of subjective norms on individual perception of the usefulness of a specific system. This is because people tend to follow the ideas of other parties that are important (Lisana, 2021; Lisana & Handarkho, 2022). Therefore, the following hypothesis was postulated:

- H1:** Subjective norms have a positive and significant direct effect on the perceived usefulness of LMS

The individual personal trait is another aspect considered to significantly affect user intention to adopt online systems (Benson et al., 2019; Handarkho, 2022). In this study, the successful use of e-learning is also affected by utilizing the platform (Pan, 2020). Therefore, when students have confidence in their capability to maximize a system's usage, they can benefit from the platform (Handarkho, 2022; Kucharska, 2019). This study proposes that computer self-efficacy influences students' perceived usefulness toward LMS adoption. This construct refers to students' confidence and perception toward their ability to maximize LMS to support the learning process by the objective intended (Handarkho, 2022; Pan, 2020). Several prior research studies have also proven how this personal characteristic can affect user perception of the usefulness of LMS (C.-T. Chang et al., 2017; Zwain, 2019). Therefore, this study proposes the following hypothesis:

H2: Computer self-efficacy has a positive and significant direct effect on the perceived usefulness of LMS

This study also involves the teaching-learning process that significantly affects students' LMS adoption. The quality of communication and interaction between teachers and students can encourage the students to explore the subject profoundly, leading to students' perception toward LMS usage (Baber, 2021; Cigdem & Ozturk, 2016). Specifically, when teachers can manage interaction and collaboration, positive perception toward the usefulness of the system can be increased, which also leads to satisfaction with the sites (Baber, 2021). Prior studies also confirmed this, which made interactivity a significant factor affecting user perception toward LMS usage (S. Chang & Kuo, 2021; Cigdem & Ozturk, 2016). Therefore, two hypotheses were developed:

H3: Interactivity in LMS has a positive and significant direct effect on the perceived usefulness of LMS

H4: Interactivity has a positive and significant direct effect on the perceived satisfaction of LMS

Another construct proposed from the learning aspect is content quality, which refers to user perception of the quality of content provided in the platform and whether it is relevant, organized, up-to-date, and easy to understand (Binyamin et al., 2018; Han et al., 2016). Therefore, when teachers, through LMS, can provide good quality learning material related to the learning process, user perception toward the usefulness of the sites can be affected (Mohammadi, 2015; Wang et al., 2019). This statement is also complemented by Ghazal et al. (2018), Kang and Namkung (2019), and Rafique et al. (2020), which put the quality attached to the platform through its content and information as a construct to increase the usefulness of technology and lead to a positive adoption process. Consequently, the following hypotheses were proposed:

H5: Content quality has a positive and significant direct effect on the perceived usefulness of LMS

H6: Content quality has a positive and significant direct effect on the perceived satisfaction of LMS

This study puts usefulness and satisfaction as a construct that represents organism from SOR frameworks, which refers to internal emotions and psychological processes between stimulus and response. These constructs mediate environmental, personal, and learning aspects, indirectly affecting students' LMS adoption. Therefore, students' satisfaction would increase user intention to explore and adopt LMS, primarily to fulfill their need for a good learning process during the COVID-19 pandemic, which aligns with several prior studies (Ghazal et al., 2018; Hassanzadeh et al., 2012; Mohammadi, 2015). This led to the formulation of the following hypothesis:

H7: Perceived satisfaction has a positive and significant direct effect on the actual use of LMS

This study proposes perceived usefulness as a direct predictor of LMS's actual use. The construct refers to how students believe using LMS can achieve their objective-related learning process. This construct is also used in GETAMEL to explain the adoption of e-learning as a solution to the

COVID-19 pandemic (Baber, 2021). Many prior studies have validated the influence of this factor (Alturki & Aldraiweesh, 2021; Hamid et al., 2020; Kimathi & Zhang, 2019; Mohammadi, 2015; Ramirez-Anormaliza et al., 2016; Scherer et al., 2019; Stockless, 2018; Weerathunga et al., 2021) to formulate the following hypothesis:

H8. Perceived usefulness has a positive and significant direct effect on the actual use of LMS

RESEARCH DESIGN AND METHODOLOGY

This study employs a quantitative field method with a cross-sectional time approach. Self-administered questionnaires were used to obtain data from students from high schools who used LMS. Furthermore, the response was used to validate the theoretical model through SEM analysis, in which the data was prepared using exploratory (EFA) and confirmatory factor analyses (CFA). The instrument used for questionnaires was adopted from a prior study, which involved the professional ensuring the translation to Indonesian does not change the original meaning and is also suitable for the context.

The choice of sampling was established based on the purposive method to ensure the respondents meet the requirements (Neuman, 2014). The minimum number of respondents was set to 400 students to achieve 5% precision and 95% confidence level, based on Israel's (2003) guidance. AMOS software used the collected data to analyze the proposed model using the structural equation modeling (SEM) technique. The result suggests theoretical and practical implications for maximizing the use of LMS in supporting the teaching-learning process.

CONSTRUCT MEASUREMENT

Table 2 provides details of each measuring instrument for each factor using a five-point Likert scale, and Figure 1 shows the proposed model, which consists of eight constructs.

Table 2. Indicators and measurement instruments

Variable (symbol)	Indicator	Measuring instrument	Adopted from
Self-Efficacy (SE)	SE1	I believe I can connect with the school LMS	(Chen & Tseng, 2012)
	SE2	I believe that I can use the LMS to get the learning information I need.	
	SE3	I believe that I can use the LMS to unlock teacher-given assignments.	
	SE4	I believe that I can use the LMS to open and take quizzes given by the teacher.	
Perceived Usefulness (PU)	PU1	Using LMS can help my learning become more efficient.	(Chen & Tseng, 2012)
	PU2	Using the LMS can help me get the learning information I need	
	PU3	Using LMS can help me in studying.	
	PU4	The use of LMS can help me improve my learning ability.	
Subjective Norm (SN)	SN1	LMS is important for my learning at school	(Binyamin et al., 2018)
	SN2	The teacher thinks that I need an LMS to help me study.	
	SN3	I want to do what my teacher thinks I should do.	
	SN4	Schools think that with LMS, my learning will increase.	
Perceived Satisfaction (PS)	PS1	I am satisfied with using LMS as a study aid	(Liaw, 2008)
	PS2	I am satisfied with using the tools in the LMS.	
	PS3	I am satisfied with the learning content in the LMS.	
Interactive Learning Activities in LMS (ILA)	ILA1	I believe LMS can help teacher-student interaction	(Liaw, 2008)
	ILA2	I believe LMS can help student-student interaction.	
	ILA3	I easily interact with other teachers through LMS when learning.	

Variable (symbol)	Indicator	Measuring instrument	Adopted from
Content Quality (CQ)	CQ1	LMS provides relevant information to help me in studying	(Moghavvemi et al., 2012)
	CQ2	The information provided by the teacher in the LMS is very well-organized	
	CQ3	information provided by the teacher in the LMS is up-to-date	
	CQ4	The information provided by the teacher in the LMS is easy for me to understand	
Actual Use (AU)	AU1	I often use LMS and get involved in it	(Binyamin et al., 2018)
	AU2	I tend to use the LMS for as long as necessary.	
	AU3	I have used LMS regularly.	

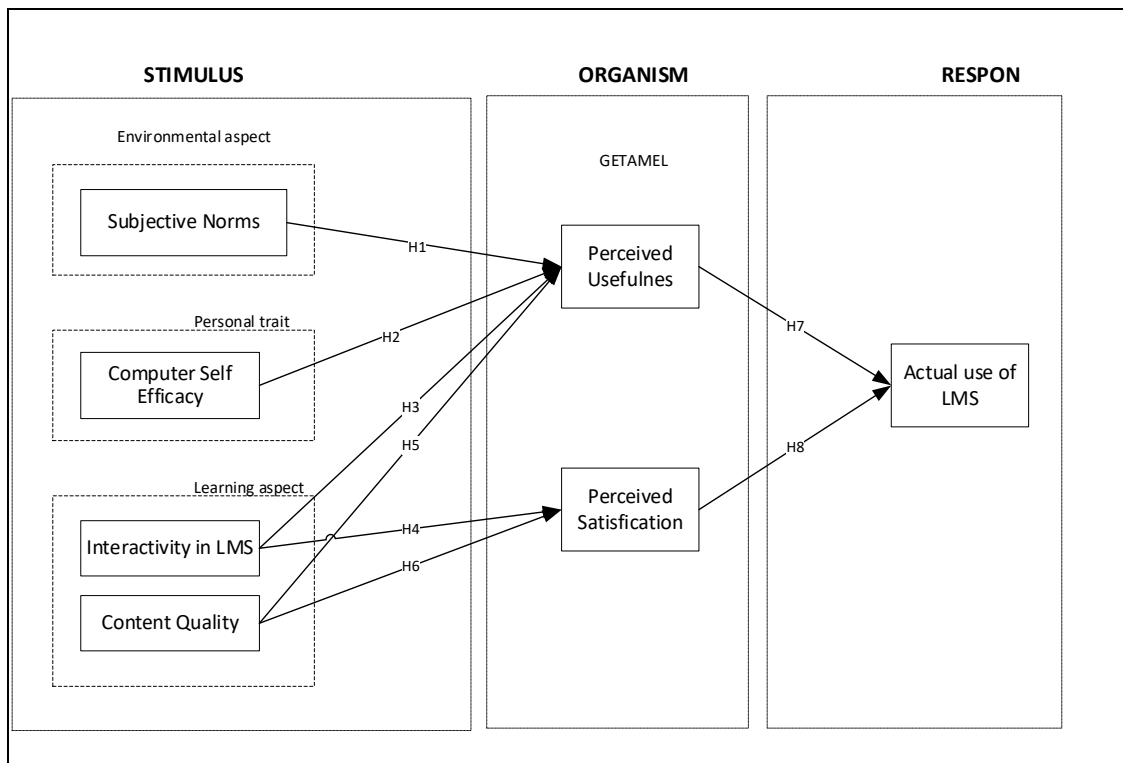


Figure 1. The proposed model

DATA PREPARATION AND DESCRIPTIVE ANALYSIS

The questionnaire distribution produced 890 valid responses used to validate the theoretical model. Furthermore, principal component factor analysis and Cronbach's alpha coefficient were employed to verify the data's construct validity and equivalence reliability. The result shows that each measurement was loaded significantly into the latent variable. Also, the result of Cronbach's alpha indicates that all variables satisfy the criterion provided by George and Mallery (2003). Confirmatory factor analysis was tested to examine the convergent validity through the value of composite reliability (CR) and average variance extracted (AVE) based on Fornell and Larcker's (1981) rules. The result shows that both AVE and CR values satisfy the requirement above 0.5 and 0.7, respectively. Meanwhile, the discriminant validity was examined through the value of AVE's square roots, which are higher than the correlations among variables in the proposed model. All the result calculations for data preparation satisfied the requirement and are presented in Tables 3 and 4.

Table 3. Results of principal factor and Cronbach alpha analysis

Indicator	Perceived usefulness	Self-efficacy	Content quality	Subjective norm	Interactive learning	Perceived satisfaction	Actual use	Cronbach's alpha
PU3	0.847	0.086	0.000	-0.035	-0.008	0.129	0.102	0.859
PU1	0.832	0.109	0.055	0.010	0.117	0.111	0.016	
PU2	0.830	0.175	0.069	-0.028	0.058	0.092	0.042	
PU4	0.768	-0.033	0.045	-0.015	0.013	0.201	0.032	
SE3	0.088	0.850	0.104	0.074	0.070	0.045	0.026	0.842
SE4	0.050	0.818	0.046	0.043	0.134	0.087	0.068	
SE1	0.041	0.771	0.031	0.050	0.010	0.007	0.088	
SE2	0.165	0.770	0.088	0.097	0.176	0.006	0.041	
CQ3	0.036	0.087	0.900	0.039	0.016	0.006	0.126	0.833
CQ4	0.031	0.042	0.890	0.054	0.021	0.032	0.132	
CQ2	0.016	0.038	0.731	-0.025	0.111	0.108	0.213	
CQ1	0.109	0.112	0.561	0.018	0.111	0.091	0.383	
SN2	-0.038	0.079	-0.013	0.843	0.036	0.025	0.063	0.822
SN4	0.001	0.013	0.000	0.807	0.021	0.017	0.052	
SN1	-0.020	0.080	0.041	0.788	0.025	0.040	-0.048	
SN3	-0.005	0.065	0.037	0.777	0.037	0.012	-0.019	
ILA2	0.010	-0.033	0.072	0.032	0.878	0.042	0.039	0.798
ILA3	0.083	0.065	0.063	-0.012	0.856	0.028	0.030	
ILA1	0.028	0.261	0.016	0.077	0.762	-0.011	0.050	
PS3	0.126	-0.021	0.070	0.036	0.006	0.843	0.036	0.761
PS1	0.149	0.077	0.072	0.088	0.020	0.804	0.029	
PS2	0.109	0.041	0.014	-0.038	0.034	0.769	0.053	
AU3	0.034	-0.072	0.130	0.004	0.066	0.125	0.853	0.708
AU2	0.025	0.150	0.111	0.055	0.028	-0.093	0.824	
AU1	0.070	0.078	0.366	-0.035	0.010	0.107	0.590	

Note: Loading factors for each indicator exceeded 0.4 in magnitude and are associated with eigenvalues of at least 1 (Straub et al., 2004)

Table 4. Results of confirmatory factor analysis

	AVE	CR	AU	PU	PS	SN	SE	ILA	
Actual Use	0.585	0.805	0.764						
Perceived Usefulness	0.672	0.891	0.140**	0.819					
Perceived Satisfaction	0.649	0.847	0.136**	0.316**	0.805				
Subjective Norm	0.647	0.880	0.036	-0.022	0.063	0.804			
Self-Efficacy	0.645	0.879	0.160**	0.220**	0.106**	0.157**	0.803		
Interactive Learning	0.695	0.872	0.117**	0.121**	0.068*	0.083*	0.239**	0.833	
Content Quality	0.613	0.860	0.488**	0.143**	0.158**	0.059	0.196**	0.159**	0.783

Note: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)

Harman's single factors method was also employed to ensure no common method biases in collected data. The result shows that the total variance value is below 50%, which is 18.992%, indicating no bias problem in the data. Meanwhile, a multicollinearity analysis was conducted to verify the variance inflation factors (VIFs) value and check the possibility of redundant information from constructs that explain the dependent variable. The result shows VIF scores in the range of 1.037-1.348, followed by tolerance values of 0.742-0.964. Therefore, the data is free from the multicollinearity problem because the VIF value is below 3.3, and the tolerance score is above 0.1 (Lisana & Handarkho, 2022).

The respondents were dominated by male students, with 74.1%, while 15 years old is recorded as the most age with 34.0%, followed by 16, 17, 14, and 18 years with 30.4%, 26.4%, 8.8%, and 0.3%, respectively. All respondents were high school students who utilized LMS to support teaching-learning processes during the COVID-19 pandemic. This study conducts descriptive statistical analysis to calculate the value of skewness and kurtosis, with results below 3 and 7, respectively. Therefore, the collected data is suitable for SEM analysis (Handarkho & Harjoseputro, 2020).

MODEL ANALYSIS

Figure 2 and Table 5 present the results of the SEM analysis of direct and indirect effects. For direct impact, perceived satisfaction is the most significant predictor of actual students' use of LMS, followed by perceived usefulness. From an environmental aspect, subjective norms were found to substantially impact usefulness, followed by computer self-efficacy from personal traits and interactivity and content quality from a learning aspect. However, the result of subjective norms is negative toward the actual usage of LMS, contrary to the proposed hypothesis. For indirect effect, all the predictors for actual use are accepted. Furthermore, content quality has the most substantial indirect effect on actual use through satisfaction, followed by self-efficacy. In general, the value of direct and indirect effect in Table 4 was presented as follows: (i) unstandardized effect followed by its statistical significance with values 0.05, 0.01, 0.001 or no significance, presented by the symbol *, **, *** or NS, respectively; and (ii) the values in parentheses refer to the standardized effect, followed by S, M, or L, representing its magnitudes, meaning small, medium, or large, respectively.

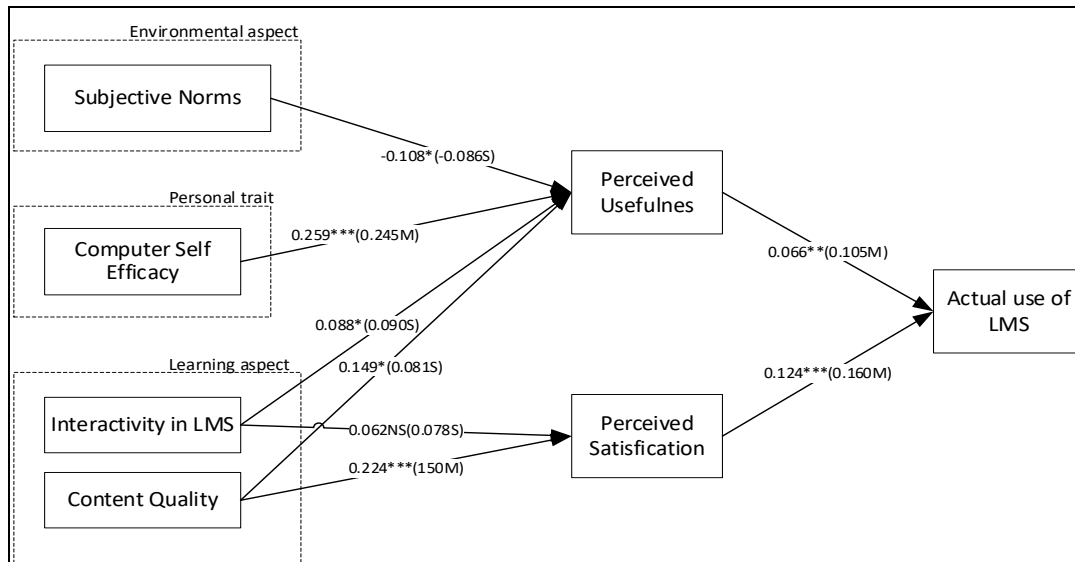


Figure 2. Model of Analysis SEM

Table 5. Hypothesis testing results

Direct effect	Total effect	Status
Subjective Norms → Perc. Usefulness (H1)	-0.108*(-0.086S)	Accepted
Self-Efficacy → Perc. Usefulness (H2)	0.259*** (0.245M)	Accepted
Interactivity → Perc. Usefulness (H3)	0.088* (0.090S)	Accepted
Interactivity → Perc. Satisfaction (H4)	0.062NS (0.078S)	Rejected
Content Quality → Perc. Usefulness (H5)	0.149* (0.081S)	Accepted
Content Quality → Perc. Satisfaction (H6)	0.224*** (0.150M)	Accepted
Perc. Satisfaction → Actual Use (H7)	0.124*** (0.160M)	Accepted
Perc. Usefulness → Actual Use (H8)	0.066** (0.105M)	Accepted

Indirect effect	Total effect	Status
Subjective Norms → Perc. Usefulness → Actual Use	-0.007*(-0.009S)	Accepted
Self-Efficacy → Perc. Usefulness → Actual Use	0.016**(0.024S)	Accepted
Interactivity → Perc. Usefulness → Actual Use	0.005*(0.006S)	Accepted
Content Quality → Perc. Usefulness → Actual Use	0.009*(0.008S)	Accepted
Interactivity → Perc. Satisfaction → Actual Use	0.004NS (0.007S)	Rejected
Content Quality → Perc. Satisfaction → Actual Use	0.026*** (0.022S)	Accepted

Note: The indirect effect was calculated using the heuristic method by Cohen and Cohen (1983)

Table 6 shows the summary of the fit statistic of the theoretical model based on collected data. The result satisfies the guidance provided by Kline (2016) with details as follows: (i) the reasonable normed chi-square values are between 1 and 5, (ii) the value of GFI, AGFI, NFI, IFI, and CFI close to 0.9, and above, refers to good model fit, and (iii) the value of RMR and RMSEA need to be close to 0, as a close fit and good model.

Table 6. Fit statistic for the proposed model

Sample size	Normed chi-square (NC) = χ^2/df	RMR	GFI	AGFI	NFI	IFI	CFI	RMSEA
890	1152.233/261= 4.415	0.038	0.906	0.883	0.879	0.903	0.903	0.062

DISCUSSION OF THE FINDINGS

SOR AND GETAMEL FRAMEWORK

This study uses usefulness and satisfaction to represent organisme factors from SOR frameworks, which refer to internal emotions and psychological processes that mediate stimulus and response. The direct effect of satisfaction (H7) is found to affect LMS usage more significantly than usefulness (H8). This indicates the ability to fulfill and satisfy students' needs for an excellent teaching-learning process affecting LMS adoption. The significant results confirm prior studies that place usefulness and satisfaction as substantial predictors of LMS usage (Alturki & Aldraiweesh, 2021; Hamid et al., 2020; Weerathunga et al., 2021).

For stimulus, students' perceived usefulness is found to be affected by self-efficacy (H2), interactivity (H3), and subjective norms (H1). From an environmental aspect, even though the result is significant, the effect of subjective norms is negative toward LMS actual usage, which is contrary to prior studies (Binyamin et al., 2018; Lisana & Handarkho, 2022). This might be associated with the definition that puts the opinions of teachers and school as a source of influence rather than close friends or family. Therefore, students will be more discouraged from using LMS when schools or teachers push them to utilize the system. This statement is also confirmed by Anindito and Handarkho (2022), who stated that students tend to consider the opinions of their peers.

From a personal trait context, the effect of self-efficacy is found to be significant in usefulness (H2). Students' confidence in their computer use capability will help minimize their effort to understand and use LMS, leading to the perception of the system's usefulness (Handarkho, 2022; Kucharska, 2019). The results confirm a prior study that acknowledges the influences of self-efficacy on the perceived usefulness of the system (C.-T. Chang et al., 2017; Zwain, 2019). The interactivity in LMS (H3) and content quality (H5) significantly affect students' perceived usefulness of LMS adoption. This result indicates that the teacher's capability to develop a supportive learning environment, followed by the provision of good quality learning material, can increase positive perception toward the usefulness of the system to support online teaching-learning processes (Baber, 2021; Cigdem & Ozturk, 2016; Mohammadi, 2015; Wang et al., 2019).

The second stimulus factor, perceived satisfaction, is found to be affected by content quality (H6), while interactivity in LMS (H4) is rejected. The result indicates that the quality of information, content, and learning material in LMS is the most influential aspect that affects students' positive perception toward platform usage, leading to satisfaction perception (Mohammadi, 2015; Rafique et al., 2020; Wang et al., 2019). The interesting result is that the effect of the interactivity of teachers and students is insignificant toward perceived satisfaction with LMS usage. Therefore, the interaction developed is optional to satisfy students with LMS. This result shows that students' satisfaction with LMS usage is more driven by the quality of learning material than by teacher effort in interacting with this platform. LMS is seen as a solution to maintain learning activities during the pandemic. This result might also be caused by the students' assumption that interaction cannot fully substitute offline class, making them not consider the mentioned factor a significant construct to their satisfaction.

THEORY IMPLICATIONS

The results of this study present a significant theoretical contribution by employing a comprehensive approach to explain the adoption of LMS among high school students after the COVID-19 pandemic. This contribution extends the GETAMEL framework by incorporating environmental, personal, and learning quality aspects while also analyzing both direct and indirect effects, which have not been previously explored in this context. Utilizing the SOR framework as a grounded theory further enhances our understanding of the mechanisms underlying students' responses toward LMS adoption. By examining how external stimuli interact with internal processes to shape students' perceptions and behaviors, the study provides valuable insights into the pathways through which LMS acceptance is formed. Moreover, the integration of indirect effect analysis enriches our comprehension of the role of student-perceived usefulness and satisfaction as direct predictors of actual LMS use. Overall, this study's theoretical model, rooted in both the SOR and GETAMEL frameworks, offers a comprehensive analysis that encompasses various factors influencing students' acceptance of LMS.

PRACTICAL IMPLICATIONS

Several practical implications are proposed based on the results to improve the use of LMS and support the teaching-learning process. First, several actions can be derived from content quality to enhance perceived satisfaction as the most influential predictor. The result shows that when students perceive that LMS can provide acceptable content and information that supports the teaching-learning process, it will lead to satisfaction with the usage. Therefore, high schools need to ensure that all content, including material, is directed thoroughly to support the teaching-learning process. This means that high schools need to ensure that the LMS position is complementary to an integral part of the learning process, which can be achieved by using LMS to conduct quizzes, assignments, and other activities.

SEM analysis indicated computer self-efficacy, subjective norms, and interactivity in LMS as predictors of students' perceived usefulness. The results show that when students have confidence in their capability to maximize LMS usage, they will benefit from their perception of the use of the system. Therefore, high school students need to gain confidence in LMS usage by familiarizing themselves with various learning activities. Furthermore, providing a user manual also can ensure their ability to maximize the use of LMS. An interesting finding is the result of subjective norms that negatively influence perceived usefulness. Specifically, teachers' and schools' opinions that push students to use LMS will discourage their intention. Therefore, high schools need to avoid an approach that forces students to use LMS because it will bring a negative perception. Another approach can be taken, such as using reward points for active students or integrating LMS with gamification techniques. Last, when teachers can manage interaction and collaboration in the learning process on the platform, it will positively affect students' perceptions. The teachers act as instructors who can facilitate interaction between students on the platform. High schools can adopt all the proposed actions above

to retain and maximize the role of LMS to support the teaching-learning process, especially in uncertain situations.

CONCLUSION

This study investigated factors affecting LMS adoption amidst the COVID-19 pandemic by proposing a theoretical model using the SOR and GETAMEL framework as a foundation. Specifically, it involves environmental, personal, and learning quality aspects to offer a comprehensive approach to explaining students' acceptance of using LMS. The results show perceived satisfaction as a direct factor most affecting LMS actual use, followed by usefulness. Furthermore, the indirect effect analysis indicates that learning affects students' satisfaction with LMS usage. Students perceived usefulness is affected mainly by computer self-efficacy from trait aspects. All three aspects proposed in the model significantly and indirectly affect LMS adoption through usefulness and satisfaction as mediators. The involvement of direct and indirect effect analysis brings a vast perspective toward LMS adoption in the high school context, especially after the pandemic situation, which contributes practically and theoretically to the body of knowledge. This study, however, is limited to collecting responses exclusively from Indonesian respondents. Therefore, the replication of the findings needs to consider the characteristics and culture similar to Indonesian students, which is regarded as the limitation of this study.

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